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INTERVALIC GROUP DISCUSSION EXCITES INTEREST IN BIOCHEMISTRY LEARNING

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ABSTRACT

The purpose of this study was to evaluate students' academic outcomes after implementation of the intervalic group discussion pedagogics in biochemistry curriculum for Applied chemistry students.

Design: 300 students were saparated into two cohorts, one taught with the traditional lecture-based methods and the other adopted the intervalic group discussion approach in biochemistry course. The effects of the two kinds of pedagogics analysis by comparing four exam scores during the semester, the final exam score was the most determining one for GPA grades.

Results: There have no statistically differences in the mean scores of the final exam score ($p=0.599$) among all students. However, the cohorts with intervalic group discussion instructional method were more apt to catch the abstractive concenptions and metabolism pathways, and they were expert on expliaing biological phenomenon and regulating microbial fermentations. If the test contents involved more applied questions during the semesster, like exam 2 and exam 3 ($p<0.05$), the mean exam scores were higher in the intervalic discussion group than in the traditional one. The abstract conceptions or the metabolism pathways were thought easier to understand after group discussion.

Conclusion: Student cohorts who taught using the intervalic group discussion approach statistically outperformed those who received the traditional lecture-based instructional method in biochemistry learning.

KEY WORDS: Group discussion; Study efficience; Educational measurement; Exam score.

INTRODUCTION:

Biochemistry is an important course for Applied chemistry students, it is one of the most important professional core curriculums. The students should be proficient with the foundational concepts, theories, and skills outside knowledge about biochemistry (Wright, A. et al. 2013; Tansey, J. T. et al. 2013).

It is said that, biochemistry is the science of life, it includes all the theoretical and practical knowledge that related to the biological basis of physiology and pathology processes of human (Feldberg, R. S. 2001).

As we know, the curriculum composes a vast number of abstract conceptions, and the metabolism pathways were inherent difficulty for the beginners (Vanderlelie, J. 2013). Therefore, how to design a reasonable and more interesting teaching course is an imperative topic for biochemistry teachers. Kusurkar et al (2013) advised that teachers should pay more attentions on understanding what students wanted from the teaching sessions, and teachers should structure the teaching formats around their wanted. Teachers must make the learning process more relevant, intriguing and interesting, to stimulating gradually the genuine interests of the students onto the subjects.

There were many kinds of methods have been tried on biochemistry teaching besides the traditional lecture based Courses. Such as the problem-based learning (PBL) method (Demirören, M. et al. 2016), case-based learning (CBL) (Gili and Rietschel, 2016), inverted classroom (Susanne, et al., 2017), and the Performance and Perceptions method to encourage the learning interests of the students in biochemistry course (Schneeb et al., 2017). In addition, the brainstorming method also applied as a teaching-learning tool among students in biochemistry teaching, the students showed enhanced learning gains compared with the same course utilizing traditional curriculum (Ezeanolue EE et al 2018; Surapaneni KM, 2010). Assessing all the improved teaching methods in biochemistry curriculum, all methods were built upon the idea of permeating practice examples in biochemistry teaching process, this phenomenon could be summarized by the proverb of " telling me and I will forget, show me and I will remember, involve me and I will understand". In fact, the didactic teaching method on abstract concepts of biochemistry learning has really appeared many drawbacks. In the traditional leacture based courses, the tedious long time solo of a teacher would diminish the student's interest and attention after 20-30 minutes, and remains just the lower non-speciallized information and even awful satisfaction.

Although the reported instruction methods like PBL, CBL, inverted classroom, Performance and Perceptions method were useful on biochemistry learning, they were all applied in a small-scale teaching group. As for a 150 students class, the effect was not so obvious like the reports in our previous experiences. To improve the teaching effect in our biochemical course, the teachers adopted the modified team based learning method in the biochemistry course. Briefly, the teachers delivered key knowledge of each chapter as table 1 showing, the teaching method was the traditional leacture based instruction with the aid of modern learning materials (e.g., flash cards, video). Then the students were seperated into 25 groups with 6 students in each group to discusse the relative concepts or topics on the physiology phenomenon of people or the process of fermentations, the objects were set by teachers. The teachers and involved students named it intervalic group discussion method. Group discussions can consolidate the memory on concepts learning and retain the contents longer than simply knowledge acquisition in class, and this method combined everyone's opinion essence together, as reported (Bobby, Z. et al., 2014).

The teaching effectiveness of intervalic group discussion in biochemistry learning was compared with that of didactic lectures. The measurement including: 1) Using multiple-choice questions and practical questions to evaluate students' understanding and simple recall on concepts. 2) Assessing the satisfaction levels of the students by encourageing them to fill out a feedback form, which is anonymous, in order to know about their preferences and suggestions regarding the improvements in the modified teaching-learning methods. 3) The students' perform in comprehensing all of the knowledge topics in a final examination at the end of the semester.

Acturally, there have no statistical difference in the final exam mean scores ($P>0.5$) among student cohorts, who taught with intervalic group disscussion method on some topics or the traditional lecture based listening courses across one academic semesster. However, the students taught with intervalic group discussion method showed better learning experience during biochemical study than the traditional lecture based participators. Morever, the students exposed to intervalic group discusstion had long-term retention on the course knowledge, which assessed with multiple-choice examination five monthes later after course completion. The students also showed more experts on physiology phenomenon explaining and microbial metabolism retelling, and they were confident on the curriculum learning than the controls with traditional pedagogic. The profits of the present investigate showed that arranging the intervalic group discussion during biochemistry teaching were necessary.

METHODS AND MATERIALS:

Setting assay:

In our collage, the over-all study of biochemistry course conducted with secondary professional year students of Applied chemistry major at East China University of Science and Technology. The students have learned general biology, organic chemistry, abiochemistry, physics and other basic subjects. The students were randomly divided into two teaching class with two different teaching pedagogics, the maximum class size was 150, the properties of the students were

collected and recorded.

Educational activity:
Each teaching class was arranged with different pedagogical approaches during a required spring semester-long biochemistry course. One class implemented the intervalic group based discussion, while the other utilized traditional lecture-based pedagogy. In the intervalic group based discussion class, students were divided into 25 teams with the fitted group number of six students (Frame T, et al., 2015). In the group discussion class, the main contents were also delivered in a lecture format each week, which composed of all concepts such as glycometabolism and gluconeogenesis. That is, the whole teaching class comprised with three successive sections, pre-class reading assigned firstly. Then followed by a content lecture in the first 20 minutes and the audience response component were incorporated at this section. Finally, the important concepts or practic topics discussed and reinforced during the following 10 minutes' group discussion section. The repeat cycles performed within the 90 minutes class. The whole biochemistry contents were delivered at the same order every week to the cohorts. Each group based discussion block has been conducted with little modify to previously described team based teaching instructions (Michaelsen LK, et al., 2008).

The effect of each pedagogical was calculated with testing grades, grades in the intevalic group based discussion course were based on the discussion components, three exams and a cumulative final exam, while the grades whom participated in the traditional lecture based teaching class were also composed by three exams and a cumulative final exam. The course objectives incorperated core concepts and opiniones in the two cohorts analyzed in a survey.

The survey was anonymous and conducted at the final exam, answeres to 6 required questions were evaluated using a 4-scale rating (1 strongly disagree, 2 disagree, 3 agree, 4 strongly agree). The four degrees rating were setted as Berk recommends (Berk RA. 2013). Every respondent choose only one answer to each question and should finish all the questions. Cognitive interview about the questionnaire was conducted within students who were similar but did not take part in the survey, in order to evaluate whether the questions could be correctly understand, and if could provide possible answer(s) or suggest any other advices on the contents of the questions, just like Wills recommended previously (Wills GB., 2004).

The survey was completed when the Applied chemistry students were all present. Everybody has only one opportunity to participate in this survey anonymously. The participants were distrubuted with an inform leaflet prior to the survey in order to provide them time to decide if they would like to take part in it, and none of them was obligated, the survey data was analysis after completed.

Statistical Analysis:
The data were captured manually using Microsoft Excel (Redmond, WA) from options 1 to 4 for each question. The data presented as mean+ standard deviation. The data comparison between the two groups used paired t-test. The compared data across the groups denoted by one way ANOVA or Kruskal Wallis, as appropriate. p value<0.05 was considered as statistically significant.

RESULTS:
Demographics:
There were 300 students (100% response rate) participated in this survey. Among the respondents, 164 (54.7%) participants were male, 136 (45.3%) were female. Most of them were Chinese Han student, around 6.3% were Chinese minority students. As for the age compositions, there were 11 (7.3 %) and 13 (8.3%) students were ≥20 years old in intervalic group discussion class and the classical teaching class. Most of them were 19 years old, there were 121(80.7%) and 122 (81.3%) in new teaching methodology class and the classical teaching class, the others were less than 18 years old. There was no statistic difference on ages between the two groups P> 0.5 (Table 2).

There has no difference on the final exam score between the two groups, however, there showed statistically difference at the other three periodic tests on the average score of the tests. The average scores of the intevalic group discussion students were 94.3, 92.7 and 96 at the three tests, the control group was 82, 73 and 86 at the three periodic tests, individiully, there showed significent difference between the two groups, P<0.5 (p=0.211 and 0.285, Table 3 shown).

Student opinion data on their level of comfort with the content and the confident on biochemistry course were assessed in this study, the results provided in table 4. Most students in both groups felt confident in selecting biochemistry course, there has no difference between the two cohorts (p=0.428), but the intervalic discussion students were much more active during the course, the students in the intervalic group discussion class could generoully express their own opinions on topics discussion or questions. Meanwhile, the intervalic group discussion students confirmed their easygoing feelings during the whole course, at least not felt tedious as the control ones did during biochemistry learning (p=0.029). There was about half of the students in both groups felt that they retained more conception during the course, 68.7% vs. 54%, the result showed statistical difference between them (p=0.0145). The intervalic group discussion students retened more significant information after course completion than the control ones, 70.7% vs. 56 % (p=0.016). The content retaining time and learning cofidence were all higher in the intervalic discussion group than in the controls. The results matched the saying, “show me and I will remember, involve me and I will understand.”

The students of the intervalic discussion group declared that they were able to explain many physiological phenomina using biochemistry knowledge, the ratio was also higher than control 75.3% to 62%, (p=0.0038). The students declared that it was not difficult for them to catch the more abstractive concepts of the course after discussing with other fellows, 54.7% vs. 42%, p=0.0202, there has analysis difference between the two groups. Actually, the corhorts in the intervalic discussion group got higher score on assessing practical questions, such as the explainations on the formation and harm of ketonemia, harm of high blood ammonia, the mechanism of cyanide poisoning, CO poisoning were more exact than the other group. Morever, the designing strateges on improving the production of glycerin, citric acid, and adenosine were all more reasonable than the gays did in the control group, the average scores of exam 2 and 3 also showed the results (Table 3).

DISCUSSION:
Our study analyzed the effact of a new didactics of intervalic group discussion on biochemistry learning. It was a kind of modified team-based learning instruction, we found that it could enhance confidence of the students on biochemistry learning and the ability of explaining physiology phenomenon and microbial metabolism regulation.

The final exam scores of the two-cohorts teached with different pedagogics were comparable, it showed a medium effect within the Appliy chemistry students with intervalic group discussion dedactics in ECUST. Checking the contents of the final exam, we found it included mainly with basic conception knowledge according to the professional requirment as table 1 list, teachers did not add practical questions in it, if the students could remember the conception, they got high exam score.

The authors still suggested strongerly the advantages using the intervalic group discussion method. Compared with the traditional lecture based pedagogics, there have more chances for the students to take part in the learing process. The intervalic group discussion students indicated more confidence on analysing practical questions using biochemistry knowledge in physiology phenomenon explanation and microbial metabolism regulation.

Our results showed that utilizing intervalic group discussion method fostered the study enthusiasm in biochemistry learning and made the abstract concept and metabolism pathway easy understood during group argument. Morever, the group discussion students were all confident on applying biochemistry knowledge on explaining physiological phenomena and the disorders which related with biochemical metabolism, and the process of microbial fermentation regulation and dysregulations. This might owed to the reasons of the students have more chance to accumulating group wisdom, and the kids could use their own style to explain the abstract concepts and the biochemical process during group discussion, if compared the process with the control groups.

Finding strategies to improve student interesting on course learning and integrate science concepts with practical examples was important for the educators. Engaging in-group discussion did increase learning efficience in biochemistry study, especially on concepts catching and the application of the learning knowledge on physiology phenominal explaining. In fact, accumulating the group wisdom could afford students a better understanding on the role of the learning subject in lives. Response to the intermittent exams, expecially exam 2 and 3, the contents mainly comprised by applicative knowledges on physicology phenominal explication and or on microbial fermentation regulation using biochemistry strategies, the intervalic group discussion students would achieve higher scores than the controls as table 3 shown in this survey. Additionally, the intervalic group discussion students were also apt to express their opinions during discussion sections. The students did not think the course was so abstract to be understood for them as the traditional lecture based pedagogic group did throughout the curriculum.

Actually, the participative behaviour in the group discussion section irritated the internal motivation of self-show and then stimulated the interesting of course learning. Several investigators reported that team based learning could improve problem solving ability and increase knowledge retention (Bleske B E, et al., 2016), and the typical team based learning approach could improve the exam score of the students in medicine, pharmacy and nursing curriculas (Donald H Lein Jr 2017). The curriculas of medicine, pharmacy and nursing depended much on practical cases, so the team based learning could accumulate much more applicated date from teachers and students, thus increased the exam outcomes undoubtingly (Huitt TW, et al., 2015). Morever, if there has “stronger” students in a group, the “weaker” ones could also be trained during group study and improved abilities or understandings on related questions, this was an obvious benefit of group learning (Koles PG, et al., 2010).

In conclusion, our findings suggest that using the intervalic group discussion pedagoge in biochemistry teaching was helpful on conception catching and prob-

lem solving (assessed via physiology phenomenon explaining and microbial fermentation regulating) when compared with traditional instructional methods. Group discussion was useful on teamwork training and communication skills (Hazel SJ, et al., 2013), and the two features deemed as core competencies for interprofessional collaborative practice (Washington (DC): Interprofessional Education Collaborative; 2011). Though the intervalic group discussion method did not increase the final exam score of the students, they enhanced the practical ability of the participators on assessing physiological phenomeno and the microbial fermentation regulating.

Further studies still needed, including analysis of long-term learning outcomes, and the confidence on group discussion, satisfaction and preceptions of the participants on knowledge acquire.

Table 1: The Objectives of the Biochemistry Course for Applied chemistry students

1.	Knowing the structure of amino acides, and the standards of the classification, chemical and physical properties of proteins.
2.	Describe the catalyze properties of enzyes, its stucture and functional relationship, it's application on pathogenesis and pharmacotherapeutic interventions.
3.	Describe the composition, the relationship of structure and function of lipids, carbohydrates and nucleic acids.
4.	Diagram the overall picture of the important metabolic pathways of the glycometabolism, lipids, proteins, nucleic acids and energy regulation in human body, noting important enzymes and regulation points.
5.	Master the relationships between metabolism defects, pathogenesis and pharmacotherapeutic intervention.
6.	Apply the knowledge of the biochemical mechanisms on homeostasis and modulations of the dysregulation of these mechanisms to prevent disaster, diagnosis and management on disease.

Table 2: Biographical traits of the survey population-Age, Gender and Ethnic Group

	Group discussion population		Traditional Teaching population		Chi-square Value	P
	N	%	N	%		
Age						
18 and younger	18	12	15	10	0.933	0.998
19	121	80.7	122	81.3		
20 and older	11	7.3	13	8.7		
Gender						
Male	86	57.3	78	52	0.191	0.499
Female	64	42.7	72	48		
Ethnic group						
Chinese	142	94.7	139	92.7	0.347	0.499
Other	8	5.3	11	7.3		

Table 3: Scores of periodic tests and final test

Items	Interventional discussion group	Traditional Lecture based course	P
Students enrolled in course	150	150	1.0
Exam 1(mean+sd)	94.3±10.4	82±8.9	0.210
Exam 2(mean+sd)	92.7±11.2	73±9.2	0.0211
Exam 3(mean+sd)	96±13.6	86±9.8	0.0285
Final Test (mean+sd)	81.4±sd	76.8±sd	0.599
	3.26	3.07	0.914

Table 4: Student opinions of the two cohorts

Survey question and topic	Control (Lecture Based) N=150 Number (%)	Interval group discussion N=150 Number (%)	P
I feel confident for selection the biology related courses	120 (80%)	129 (86%)	0.428
I retained a significant amount of conceptoin of biochemistry	103 (68.7%)	81(54%)	0.0145
I was able to retain a lot of information after the course	106 (70.7%)	84 (56%)	0.0164
I was able to appliy biochemical knowledge in living	113 (75.3%)	93 (62%)	0.0038
I think the course was easy to learn	86 (57.3%)	67 (44.7%)	0.0202
I was able to catch the abstract concepts of the biochemistry	82 (54.7%)	63 (42%)	0.0167
I think the course was easygoing	114 (76%)	93 (62%)	0.0294

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